TCEQ DOCKET NO. 2010-0237-MWD

APPLICATION OF THE CITY OF BULLARD FOR TPDES PERMIT FOR MUNICIPAL WASTEWATER AMENDMENT TO PERMIT NO. WQ0011787001	§ § § § §	**BEFORE THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY**

<u>HRC CHEROKEE TREE FARM, L.P.'S REPLY TO RESPONSES TO HEARING REQUESTS</u>

COMES NOW HRC Cherokee Tree Farm, L.P. ("HRC") and pursuant to 30 Texas Administrative Code ("TAC"), Chapter 55, Subchapter F (Sections 55.200-55.211) submits this Reply to Responses to Hearing Requests to the Texas Commission on Environmental Quality ("TCEQ" or "Commission") to support its request for contested case hearing and reply to the responses filed by City of Bullard ("Applicant"), Executive Director, and Office of Public Interest Council ("OPIC"). In support of this Reply, Cherokee submits the following:

FACT SUMMARY

Applicant applied for a major amendment to its TPDES Permit No. WQ0011787001 ("Permit") to allow Applicant to discharge municipal wastewater into an unnamed tributary of Flat Creek at more than double the average daily flow of municipal discharge. HRC owns property abutting and traversed by Flat Creek less than 3 miles downstream from the discharge point. Additionally, the TCEQ issued Water Use Permit No. 12047 to HRC on August 26, 2008, which permits HRC to construct and maintain two reservoirs for contact recreation purposes on Flat Creek approximately 3.1 miles downstream of the discharge point. Design of these reservoirs is underway, and HRC expects to commence construction in the near future. HRC also owns and operates four groundwater wells on its property for purposes of irrigation and maintaining lake levels. HRC timely filed a request for contested case hearing.

DISCUSSION

The Commission shall grant a contested case hearing on a legally authorized request timely filed by an affected person that raises relevant and material disputed issues of fact and complies with the requirements of 30 TAC § 55.201.[1] The Responses filed by Applicant, Executive Director, and OPIC recommending denial of HRC's request for a hearing focus on (1) whether HRC is an "affected person" entitled to request a hearing and (2) which fact issues raised by HRC should be referred to hearing. Because HRC is an affected person and issues raised by HRC are relevant and material disputed issues of fact, HRC's request for contested case hearing should be granted and HRC's issues recommended by the Executive Director should be included in the referral.

Affected Person

To be an "affected person" entitled to a hearing, HRC must show it has a justiciable interest that may be affected by the proposed activity.[2] Importantly, a request is not required to prove the requester "will ultimately prevail on the merits;" rather, the request must merely "show that they will potentially suffer harm…."[3] As owner of property directly downstream of the discharge point that abuts and is traversed by Flat Creek, owner of groundwater wells in proximity to the receiving waters, and permit holder of a water use permit issued by the TCEQ for two reservoirs on Flat Creek, HRC clearly has personal justiciable interests not common to members of the general public. So, the only issue as to whether HRC is an "affected person" entitled to a contested case hearing is whether HRC's personal justiciable interests may be affected by the Permit.

---

[1] 30 TEX. ADMIN. CODE § 55.211(c)(2).
[2] Id. § 55.203.
[3] United Copper Indus. v. Grissom, 17 S.W.3d 797, 803 (Tex. App.—Austin 2000, pet. dism'd).

When determining whether HRC is affected, the Commission shall consider "*all* factors, including, but not limited to, the following:

(1) whether the interest claimed is one protected by the law under which the application will be considered;

(2) distance restrictions or other limitations imposed *by law* on the affected interest;

(3) whether a reasonable relationship exists between the interest claimed and the activity regulated;

(4) likely impact of the regulated activity on the health and safety of the person, and the use of property of the person; [and]

(5) likely impact of the regulated activity on use of the impacted natural resource by the person…."[4]

Thus, the Commission is not entitled to make a fact determination on a single factor listed above, but rather, must consider all factors, including each factor listed above. First, HRC's health and safety, property ownership, contact recreational use of Flat Creek as a property owner, and groundwater wells are all interests specifically protected by Chapter 26 of the Texas Water Code ("Code") and TCEQ Rules.[5]

Second, neither the Code nor TCEQ rules impose any distance restrictions precluding HRC's claims. Applicant cites no legal support in its brief for its argument that HRC's request should be denied because "HRC's land lies outside the one (1) mile radius of the discharge point." Applicant seems to be referencing a "1-mile radius" criteria often referenced by practitioners. However, the TCEQ rules requiring applicants to notify landowners within one mile downstream of the discharge point does not establish a distance restriction that precludes

[4] 30 TEX. ADMIN. CODE § 55.203(c) (emphasis added).

[5] *See generally* TEX. WATER CODE ANN. §§ 26.003, 26.023, 26.030, 26.401 and 30 TEX. ADMIN. CODE § 307.

others further downstream from being affected. Because the "1-mile radius" rule of thumb is not "imposed by law,"[6] it is not a proper consideration and does not preclude HRC, who is closely downstream of the discharge point but further than one mile, from requesting a contested case hearing.

Third, a reasonable relationship clearly exists between discharging municipal wastewater into a creek and use and ownership of property directly downstream and abutting the creek, use of groundwater wells near the creek, and holding a permit to construct reservoirs on the creek directly downstream of the proposed discharge point.

Fourth, HRC owns property abutting and traversed by Flat Creek. Additionally, not only is the portion of Flat Creek within HRC's property currently suitable for contact recreation use, but TCEQ has also authorized HRC to use its property along Flat Creek to construct reservoirs for contact recreation. Of course, enjoying the beauty and quality of both Flat Creek and its permitted reservoirs is a valuable use of HRC's property now and in the future. But, as initially asserted by HRC in its request, the Permit's proposed discharge (10/15/3) will likely result in degradation of water quality in Flat Creek beyond a de minimis extent. Flat Creek often experiences very low flows, so a Permit authorizing Applicant to more than double its discharge will result in the discharge comprising a large percentage of flow in Flat Creek.

Although not required to prove it will ultimately prevail on the merits of these claims, HRC engaged Mr. James L. Machin, P.E. and Senior Engineer at TRC, Austin, Texas, to conduct an analysis of the effects of the Permit on HRC's property downstream. The findings and conclusions of this analysis, which further support HRC's position, are attached as Exhibit A, along with Mr. Machin's résumé. In short, the analysis shows the concentrations of total phosphorus in Flat Creek (prior to the construction of the reservoirs) could potentially rise from a

[6] 30 TEX. ADMIN. CODE § 55.203(c)(2).

background level of 0.12 mg/L at the point of discharge to as much as an average of 1.17 mg/L at HRC's property as a result of the proposed discharge, and the concentration of total nitrogen could potentially rise from a background level of 1.10 mg/L at the point of discharge to as much as 5.18 mg/L at HRC's property. The significantly elevated phosphorus and nitrogen levels will likely cause algal blooms,[7] harm the aesthetics of Flat Creek and HRC's property,[8] cause wide swings in dissolved oxygen levels,[9] and otherwise negatively impact the water quality in Flat Creek. A travel distance of less than three miles from the discharge point is not sufficient to eliminate this negative effect and prevent it from affecting HRC's property and use of Flat Creek. Ultimately, HRC's analysis shows the Permit's proposed discharge, considering the quality and quantity, will likely negatively impact HRC's use of Flat Creek and its property abutting Flat Creek.

Lastly, although the Executive Director and Applicant assert that only impacts on existing bodies of water can be considered in evaluating the Application, they cite no legal authority for this assertion. In fact, 30 TAC 55.203(c) states very clearly that "all factors shall be considered" by the Commission when determining whether a person is affected, which would specifically include considering the effects on reservoirs permitted by the TCEQ and currently in the design process. As indicated in its request and the attached Exhibit A, HRC's analysis included potential effects of the Permit on both Flat Creek as it currently exists and the northernmost reservoir ("North Lake"), and both Flat Creek and the North Lake will likely be impacted by the Permit.

Ultimately, HRC's request and the information provided in this Reply make the requisite showing that HRC has a personal justiciable interest distinct from the general public that will

[7] *See* 30 TEX. ADMIN. CODE § 307.4(e).
[8] *See* 30 TEX. ADMIN. CODE § 307.4(b)(4).
[9] *See* 30 TEX. ADMIN. CODE § 307.4(h).

likely be affected by the Permit. As such, HRC is an affected person, and the Commission should grant HRC's contested case hearing request.

Disputed Issues of Fact

After determining HRC is an affected person entitled to a contested case hearing, the Commission must determine which fact issues raised by HRC are relevant and material to the issuance of the Permit. The issues recommended in the Executive Director's Response to Hearing Requests include issues raised by HRC's request regarding protection of surface water quality, protection of groundwater, Applicant's compliance history, TCEQ's regionalization policy, and protection of health and safety and use of property. Each issue raised by HRC and recommended by the Executive Director is a relevant and material issue of fact within the Commission's jurisdiction. Accordingly, HRC supports and recommends referral of Issues 1, 4, 6, 8, and 9 in Section VI.C. of the Executive Director's Response to Hearing Requests. Additionally, HRC recognizes the recommended issues may be resolved through alternative dispute resolution ("ADR"), and HRC remains willing to participate in ADR upon a granting of a contested case.

PRAYER

FOR THESE REASONS, HRC respectfully requests that the Commission:

(1) find HRC is an affected party entitled to a contested case hearing, grant HRC's request for contested case hearing, and refer Issues 1, 4, 6, 8, and 9 in Section VI.C. of the Executive Director's Response to Hearing Requests to the State Office of Administrative Proceedings for a proceeding of nine months duration; or

(2) alternatively, pursuant to 30 TAC § 55.211(b)(4), refer HRC's request to the State Office of Administrative Hearings to determine whether HRC is an affected person.

Respectfully submitted,

McGINNIS, LOCHRIDGE & KILGORE, L.L.P.
600 Congress Avenue, Suite 2100
Austin, Texas 78701
Telephone: 512-495-6000
Facsimile: 512-495-6093

By:_______________________________
Philip S. Haag, SBN 08657800
Scott Rhodes, SBN 24053590

ATTORNEYS FOR HRC CHEROKEE TREE FARM, L.P.

CERTIFICATE OF SERVICE

By my signature above, I certify that on April 19, 2010, an original and seven true and correct copies of this Reply were filed with the Office of the Chief Clerk, and a copy was sent by first class mail and/or facsimile to the persons listed in the attached Mailing List.

MAILING LIST
CITY OF BULLARD
DOCKET NO. 2010-0237-MWD; PERMIT NO. WQ0011787001

<u>FOR THE APPLICANT:</u>
Larry Morgan, City Manager
Mark Barker
City of Bullard
P.O. Box 107
Bullard, Texas 75757
Tel: (903) 894-7233
Fax: (903) 894-8163

Scott Wetzel
BWR Corporation
810 Hesters Crossing Rd., Ste. 225
Round Rock, Texas 78681-7838
Tel: (512) 826-0076
Fax: (512) 826-0077

<u>FOR THE EXECUTIVE DIRECTOR:</u>
Michelle Bacon, Staff Attorney
Texas Commission on Environmental Quality
Environmental Law Division, MC-173
P.O. Box 13087
Austin, Texas 78711-3087
Tel: (512) 239-0600
Fax: (512) 239-0606

Thomas Harrigan, Technical Staff
Texas Commission on Environmental Quality
Water Quality Division, MC-148
P.O. Box 13087
Austin, Texas 78711-3087
Tel: (512) 239-4521
Fax: (512) 239-4430

<u>FOR PUBLIC INTEREST COUNSEL:</u>
Mr. Blas J. Coy, Jr., Attorney
Texas Commission on Environmental Quality
Public Interest Counsel, MC-103
P.O. Box 13087
Austin, Texas 78711-3087
Tel: (512) 239-6363
Fax: (512) 239-6377

<u>FOR OFFICE OF PUBLIC ASSISTANCE:</u>
Ms. Bridget Bohac, Director
Texas Commission on Environmental Quality
Office of Public Assistance, MC-108
P.O. Box 13087
Austin, Texas 78711-3087
Tel: (512) 239-4000
Fax: (512) 239-4007

<u>FOR ALTERNATIVE DISPUTE RESOLUTION:</u>
Mr. Kyle Lucas
Texas Commission on Environmental Quality
Alternative Dispute Resolution, MC-222
P.O. Box 13087
Austin, Texas 78711-3087
Tel: (512) 239-4010
Fax: (512) 239-4015

<u>FOR THE CHIEF CLERK:</u>
Ms. LaDonna Castañuela
Texas Commission on Environmental Quality
Office of Chief Clerk, MC-105
P.O. Box 13087
Austin, Texas 78711-3087
Tel: (512) 239-3300
Fax: (512) 239-3311

<u>REQUESTER(S):</u>
Scott Rhodes
McGinnis, Lochridge, Kilgore, L.L.P.
600 Congress Avenue, Ste. 2100
Austin, Texas 78701

Axum Teferra
Lowerre, Frederick, Perales, Allmon & Rockwell
707 Rio Grande St., Ste. 200
Austin, Texas 78701

INTERESTED PERSONS:

Eric Allmon
Lowerre, Frederick, Perales, Allmon &
Rockwell
707 Rio Grande St., Ste. 200
Austin, Texas 78701

James L. Machin, P.E.
TRC Environmental Corporation
505 E. Huntland Dr., Ste. 250
Austin, Texas 78752

Bill McMahan
Crow Holdings
3819 Maple Avenue
Dallas, Texas 75219

EXHIBIT A

TRC

TRC
505 E. Huntland Dr.
Suite 250
Austin, TX 78752

Main 512/343-1070
Fax 512/343-1083

Technical Memorandum

From: James L. Machin

Subject: Bullard Nutrient Impact

Date: April 14, 2010

The attached workbook contains an evaluation of the potential nutrient impacts of the City of Bullard's proposed wastewater discharge major permit amendment on HRC Cherokee Tree Farm's lakes and on Flat Creek above the lakes.

The bases of the evaluation are as follows:

- A monthly model was prepared, which included mixing of Bullard WWTP effluent with the natural inflows to the north lake and the water in the lake. Another model was prepared for Flat Creek, which included mixing of the effluent with the inflows.
- Flow used for the expanded Bullard WWTP was the proposed permitted flow of 438,000 gallons per day.
- Typical total phosphorus (P) concentration in secondary municipal wastewater effluent ranges between 5 and 20 mg/L. The low end of 5 mg/L for Bullard's effluent was assumed.
- Typical total nitrogen (N) concentration (total Kjeldahl N + nitrate-N + nitrite-N) in secondary municipal wastewater effluent is between 20 and 30 mg/L. The low end of 20 mg/L for Bullard's effluent was assumed.
- Monthly naturalized inflows to the lake (essentially the flows in Flat Creek) were obtained for the period 1940-1996 from the TCEQ Neches Water Availability Model. A total of 684 months was modeled.
- Background phosphorus and nitrogen data were obtained from the TCEQ water quality data base for all samples collected in Segment 0604, Neches River below Lake Palestine, for 1972-2008. The averages of these data were used for the inflow concentrations to the Lake.
- All substances were treated as conservative. No uptake rates, chemical interactions, nutrient recycling, or nitrogen fixation were applied. It is recognized that this is a simplified model and that P and N chemistry in natural waters is very complex.

The results of the model show that significant concentrations of P and N could occur in Flat Creek and the lake. Results are summarized in the following table:

	North Lake		Flat Creek	
	Total-P, mg/L	**Total-N, mg/L**	**Total-P, mg/L**	**Total-N, mg/L**
Avg. Monthly	0.63	3.07	1.17	5.18
Max. Monthly	1.86	7.84	3.65	14.76

As stated above, P and N chemistry in natural waters is very complex, and this model is not represented as being a precise predictor. However, it shows that there could be significant concentrations of nutrients in both Flat Creek above the lake and the lake itself as a result of the Bullard discharge, if there is no nutrient removal in the treatment process. A travel distance of 2.9 miles to HRC's property and 3.1 miles to the north lake would be insufficient to eliminate the impact of this.

EPA recommended boundaries for trophic classification of streams in this region are as follows:

Nutrient	**Oligotrophic-Mesotrophic Boundary**	**Mesotrophic-Eutrophic Boundary**
Total-N, mg/L	0.700	1.500
Total-P, mg/L	0.025	0.075

Source: Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion V. EPA 822-B-01-014, December 2001.

Nitrogen and especially phosphorus levels modeled are up to two orders of magnitude higher than these recommended limits, putting these waters well into the eutrophic range. This will likely cause excessive algal growth and result in a significant degradation of water quality.

INFLOWS INTO NORTH LAKE (AC-FT)

NORTH LAKE REGULATED STREAMFLOWS (AC-FT) AT CONTROL POINT CT FINAL REGULATED FLOW

C:\ACTIVE\NECHES\CCF\5-ME\NL.WK3

TOTAL AMOUNT IN DROUGHT 19696 ACRE-FEET
TOTAL # OF MONTHS IN DROU 47 MONTHS
TOTAL # OF YEARS IN DROUG 3.916667 YEARS
ANNUALIZED AMOUNT DURIN(5028.766 ACRE-FEET PER YEAR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	AVG
1940	128	273	154	404	286	207	314	65	78	44	1730	2266	5949	496
1941	1870	985	1662	1079	716	2377	648	90	95	395	456	983	11356	946
1942	701	834	754	3400	1683	1381	160	152	427	146	270	422	10330	861
1943	1242	399	548	734	1239	1690	152	30	37	669	179	442	7361	613
1944	1886	2345	2764	911	5347	836	94	50	87	55	247	1140	15762	1314
1945	2543	1440	4276	7305	585	600	1301	141	121	1056	522	947	20837	1736
1946	2826	2318	2573	1406	2977	2911	348	471	940	463	3872	1835	22940	1912
1947	2026	1011	2148	2488	970	518	150	56	97	79	258	1080	10881	907
1948	945	2123	1923	669	1650	201	127	32	31	40	139	188	8068	672
1949	654	970	1377	1564	388	226	90	80	69	591	518	376	6903	575
1950	1792	3511	819	966	1865	1041	180	89	122	86	158	176	10805	900
1951	282	638	740	526	402	310	86	24	51	42	112	239	3452	288
1952	318	738	872	1633	860	415	47	16	16	16	104	469	5504	459
1953	684	386	1646	463	3694	139	127	51	51	35	129	580	7985	665
1954	482	378	375	418	1573	99	19	16	16	170	1002	611	5159	430
1955	656	1096	1464	1417	616	251	100	46	102	75	49	127	5999	500
1956	225	594	224	136	1371	41	17	16	16	16	39	53	2748	229
1957	102	318	432	3826	3790	2568	90	63	61	777	2115	994	15136	1261
1958	1374	972	824	933	4428	294	691	68	282	240	274	365	10745	895
1959	365	947	923	1640	3558	860	414	200	94	235	292	1094	10622	885
1960	2301	1288	1758	540	321	220	354	89	90	300	519	3847	11627	969
1961	3422	2512	2426	1103	380	545	337	104	131	123	300	1484	12867	1072
1962	1328	1022	1236	815	411	92	107	144	31	62	126	190	5564	464
1963	233	182	294	1006	866	43	18	17	16	17	22	39	2753	229
1964	74	162	390	136	178	89	17	17	17	17	35	28	1160	97
1965	168	971	332	301	1822	100	20	17	24	16	16	62	3849	321
1966	86	314	192	6113	2465	85	36	139	387	86	137	204	10244	854
1967	294	197	256	811	523	1157	31	16	46	144	642	1232	5349	446
1968	1683	1238	1895	2752	6689	860	462	44	104	75	274	884	16960	1413
1969	461	1600	3026	1797	3100	223	21	17	16	20	218	806	11305	942
1970	907	1468	2280	800	278	211	21	17	65	2023	661	293	9024	752
1971	279	402	372	176	110	26	18	110	35	175	543	3371	5617	468
1972	2136	697	299	155	97	108	29	52	17	166	822	816	5394	450
1973	1018	1049	2881	3465	624	5166	120	84	312	830	891	1430	17870	1489
1974	1571	900	965	698	1124	198	22	23	396	205	2852	1541	10495	875
1975	1186	1849	1230	1443	2233	658	66	23	27	28	61	127	8931	744
1976	256	324	778	994	1306	2111	890	38	1475	768	532	1796	11268	939
1977	861	2986	2320	2727	233	852	26	16	47	17	72	145	10302	859
1978	297	667	1555	267	415	79	16	17	16	16	61	70	3476	290
1979	372	399	753	2005	1764	384	48	225	155	26	78	546	6755	563
1980	1418	944	486	1109	677	34	16	16	16	16	20	20	4772	398
1981	42	89	191	105	1284	3153	51	17	17	280	230	274	5733	478
1982	255	291	439	222	359	228	189	16	16	25	222	2218	4480	373
1983	548	2029	1200	438	901	724	443	40	21	16	90	233	6683	557
1984	235	1265	2336	340	80	30	16	16	16	79	173	527	5113	426
1985	367	1853	1224	704	697	41	20	16	16	137	796	2348	8219	685
1986	299	1739	233	3681	3702	1458	109	16	16	97	681	1938	13969	1164
1987	868	1378	2788	264	211	1071	70	16	20	44	454	3379	10563	880
1988	1431	1315	1926	869	137	111	22	16	16	17	214	277	6351	529
1989	315	924	714	660	5441	723	51	79	19	16	16	95	9053	754
1990	742	739	2776	2060	2526	910	112	119	73	353	764	1008	12182	1015
1991	2325	1999	1094	1786	972	359	162	328	163	151	703	2784	12826	1069
1992	2048	2840	1988	396	261	194	113	16	16	130	565	1754	10321	860
1993	2887	1381	1458	771	393	243	46	42	88	1039	295	322	8965	747
1994	360	2202	981	245	1471	58	93	16	16	1204	937	2810	10393	866
1995	1675	681	898	1446	1974	16	16	16	16	16	16	44	6814	568
1996	201	179	148	464	251	36	16	120	161	168	247	530	2521	210
AVG	983	1129	1274	1326	1478	694	164	68	121	248	487	945	8918	743
MAX	3422	3511	4276	7305	6689	5166	1301	471	1475	2023	3872	3847	22940	
MIN	42	89	148	105	80	16	16	16	16	16	16	20	1160	

North Lake - Assumes lake starts full of water with average of all months' concentration.

980.5 N. Lake Volume, ac-ft

438000 Bullard flow, gpd   5 Bullard P, mg/L[1]   0.12 Background P, mg/L[2]

Bullard, af/mc	41.7	38.0	41.7	40.3	41.7	40.3	41.7	41.7	40.3	41.7	40.3	41.7

P Values in Lake, mg/L, at end of month[3]   TRC/04-15-10

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1940	0.73	0.73	0.80	0.73	0.73	0.77	0.75	0.87	0.97	1.09	0.54	0.31	0.75
1941	0.25	0.28	0.25	0.28	0.32	0.24	0.31	0.47	0.60	0.60	0.57	0.44	0.39
1942	0.42	0.38	0.38	0.22	0.23	0.25	0.40	0.53	0.53	0.64	0.67	0.63	0.44
1943	0.43	0.47	0.47	0.43	0.34	0.27	0.42	0.59	0.75	0.60	0.68	0.63	0.51
1944	0.36	0.25	0.21	0.27	0.17	0.25	0.42	0.58	0.71	0.84	0.84	0.54	0.45
1945	0.29	0.26	0.19	0.15	0.27	0.33	0.30	0.44	0.57	0.43	0.44	0.38	0.34
1946	0.24	0.21	0.20	0.23	0.20	0.19	0.32	0.39	0.35	0.41	0.22	0.22	0.27
1947	0.22	0.26	0.23	0.21	0.26	0.34	0.48	0.63	0.75	0.86	0.84	0.55	0.47
1948	0.44	0.28	0.24	0.31	0.26	0.40	0.53	0.70	0.85	0.98	1.02	1.02	0.59
1949	0.77	0.53	0.37	0.29	0.38	0.49	0.62	0.75	0.87	0.70	0.62	0.62	0.58
1950	0.36	0.21	0.28	0.30	0.25	0.28	0.42	0.57	0.67	0.79	0.85	0.89	0.49
1951	0.85	0.66	0.54	0.51	0.53	0.57	0.70	0.86	0.98	1.11	1.15	1.08	0.80
1952	0.97	0.70	0.53	0.35	0.35	0.41	0.58	0.75	0.90	1.06	1.11	0.91	0.72
1953	0.69	0.65	0.39	0.43	0.23	0.38	0.52	0.67	0.81	0.95	1.00	0.79	0.63
1954	0.69	0.65	0.64	0.61	0.38	0.53	0.70	0.86	1.01	1.02	0.66	0.57	0.69
1955	0.50	0.38	0.31	0.28	0.34	0.44	0.58	0.74	0.83	0.94	1.06	1.10	0.62
1956	1.05	0.80	0.82	0.88	0.52	0.67	0.84	0.99	1.14	1.27	1.37	1.45	0.98
1957	1.46	1.24	1.02	0.34	0.21	0.20	0.37	0.54	0.68	0.54	0.31	0.31	0.60
1958	0.28	0.29	0.32	0.32	0.19	0.32	0.36	0.52	0.57	0.63	0.66	0.65	0.43
1959	0.64	0.47	0.40	0.30	0.20	0.27	0.36	0.48	0.61	0.67	0.68	0.47	0.46
1960	0.29	0.27	0.25	0.33	0.42	0.52	0.55	0.68	0.79	0.77	0.66	0.27	0.48
1961	0.20	0.19	0.20	0.25	0.36	0.39	0.47	0.60	0.70	0.80	0.77	0.46	0.45
1962	0.35	0.32	0.30	0.32	0.40	0.54	0.67	0.75	0.90	1.01	1.05	1.04	0.64
1963	1.00	1.00	0.93	0.61	0.48	0.64	0.80	0.96	1.10	1.24	1.37	1.46	0.97
1964	1.51	1.43	1.17	1.18	1.16	1.21	1.35	1.47	1.59	1.70	1.78	1.86	1.45
1965	1.72	1.00	0.91	0.85	0.44	0.58	0.75	0.91	1.05	1.19	1.32	1.40	1.01
1966	1.43	1.22	1.18	0.29	0.23	0.39	0.56	0.67	0.64	0.77	0.84	0.86	0.76
1967	0.83	0.84	0.83	0.61	0.56	0.41	0.58	0.75	0.89	0.94	0.72	0.47	0.70
1968	0.32	0.29	0.25	0.21	0.16	0.24	0.34	0.51	0.64	0.77	0.76	0.56	0.42
1969	0.55	0.35	0.23	0.23	0.19	0.34	0.52	0.69	0.85	1.00	0.98	0.69	0.55
1970	0.52	0.35	0.25	0.30	0.41	0.51	0.68	0.85	0.96	0.46	0.43	0.51	0.52
1971	0.57	0.56	0.58	0.66	0.77	0.91	1.06	1.12	1.23	1.20	0.92	0.35	0.83
1972	0.25	0.30	0.41	0.53	0.66	0.76	0.91	1.03	1.17	1.16	0.78	0.58	0.71
1973	0.44	0.36	0.23	0.19	0.28	0.18	0.35	0.51	0.55	0.46	0.40	0.31	0.36
1974	0.27	0.29	0.31	0.34	0.32	0.44	0.61	0.78	0.71	0.76	0.33	0.28	0.45
1975	0.28	0.24	0.26	0.26	0.22	0.30	0.47	0.64	0.79	0.94	1.05	1.09	0.55
1976	1.02	0.92	0.67	0.48	0.36	0.26	0.30	0.48	0.34	0.35	0.39	0.29	0.49
1977	0.32	0.21	0.21	0.20	0.34	0.34	0.52	0.69	0.83	0.99	1.08	1.10	0.57
1978	1.00	0.74	0.44	0.51	0.53	0.66	0.83	0.99	1.13	1.27	1.34	1.40	0.90
1979	1.17	0.98	0.71	0.38	0.28	0.37	0.54	0.62	0.70	0.86	0.96	0.77	0.69
1980	0.47	0.39	0.43	0.35	0.37	0.54	0.72	0.88	1.03	1.17	1.30	1.43	0.76
1981	1.51	1.52	1.42	1.43	0.76	0.32	0.49	0.67	0.83	0.81	0.82	0.80	0.95
1982	0.80	0.77	0.70	0.73	0.70	0.74	0.79	0.94	1.09	1.22	1.15	0.49	0.84
1983	0.48	0.30	0.29	0.37	0.35	0.36	0.42	0.59	0.75	0.91	1.00	0.97	0.57
1984	0.94	0.55	0.31	0.40	0.55	0.71	0.87	1.03	1.17	1.24	1.20	0.94	0.83
1985	0.84	0.43	0.35	0.36	0.38	0.54	0.71	0.88	1.02	1.06	0.74	0.36	0.64
1986	0.45	0.31	0.43	0.23	0.19	0.23	0.39	0.57	0.74	0.84	0.65	0.36	0.45
1987	0.35	0.29	0.22	0.35	0.47	0.38	0.54	0.71	0.86	0.99	0.84	0.33	0.53
1988	0.29	0.27	0.24	0.29	0.44	0.57	0.73	0.90	1.04	1.19	1.13	1.04	0.68
1989	0.94	0.63	0.53	0.47	0.21	0.28	0.46	0.60	0.77	0.93	1.07	1.14	0.67
1990	0.80	0.61	0.30	0.24	0.21	0.27	0.43	0.56	0.70	0.68	0.54	0.42	0.48
1991	0.27	0.23	0.27	0.24	0.28	0.38	0.50	0.55	0.64	0.73	0.58	0.29	0.41
1992	0.24	0.20	0.21	0.32	0.43	0.54	0.66	0.82	0.98	1.02	0.80	0.43	0.56
1993	0.25	0.25	0.25	0.30	0.39	0.49	0.65	0.80	0.89	0.59	0.62	0.63	0.51
1994	0.63	0.33	0.33	0.44	0.33	0.49	0.63	0.79	0.95	0.58	0.45	0.26	0.52
1995	0.25	0.30	0.32	0.28	0.24	0.42	0.60	0.77	0.93	1.08	1.21	1.32	0.64
1996	1.25	1.20	1.20	0.96	0.93	1.06	1.20	1.23	1.20	1.18	1.10	0.87	1.11
AVG	0.64	0.53	0.47	0.42	0.39	0.45	0.59	0.74	0.85	0.89	0.85	0.73	0.63
MAX	1.72	1.52	1.42	1.43	1.16	1.21	1.35	1.47	1.59	1.70	1.78	1.86	1.86
MIN	0.20	0.19	0.19	0.15	0.16	0.18	0.30	0.39	0.34	0.35	0.22	0.22	0.15

Days/mo	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25

[1] Typical municipal wastewaters will have between 5 and 20 mg/L of total phosphorus. (EPA, 2006)

EPA/625/R-06/016, September 2006, Process Design Manual, Land Treatment of Municipal Wastewater Effluents

[2] Average of all historical data in TCEQ segment 0604 data base

[3] End of month concentration = (inflows * background conc + effluent * effluent conc + lake volume * previous month lake conc)/(inflows + effluent flow + lake volume)

North Lake - Assumes lake starts full of water with average of all months' concentration.

980.5 N. Lake Volume, ac-ft

438000 Bullard flow, gpd   20 Bullard Tot-N, mg/L[1]   1.10 Background Tot-N, mg/L [2]

Bullard, af/mc	41.7	38.0	41.7	40.3	41.7	40.3	41.7	41.7	40.3	41.7	40.3	41.7

Tot-N Values in Lake, mg/L, at end of month [3]   TRC/04-15-10

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1940	3.02	3.11	3.45	3.25	3.31	3.49	3.44	3.94	4.33	4.80	2.70	1.82	3.39
1941	1.62	1.71	1.62	1.70	1.89	1.55	1.84	2.46	2.98	2.95	2.85	2.35	2.13
1942	2.27	2.10	2.10	1.49	1.53	1.59	2.18	2.67	2.69	3.11	3.22	3.08	2.34
1943	2.31	2.44	2.44	2.28	1.96	1.69	2.27	2.93	3.52	2.97	3.26	3.09	2.60
1944	2.04	1.59	1.43	1.66	1.31	1.62	2.26	2.90	3.38	3.91	3.87	2.72	2.39
1945	1.77	1.66	1.35	1.22	1.66	1.91	1.78	2.35	2.84	2.30	2.36	2.13	1.94
1946	1.57	1.45	1.42	1.54	1.41	1.37	1.87	2.13	2.00	2.23	1.48	1.51	1.66
1947	1.49	1.64	1.52	1.43	1.66	1.95	2.48	3.09	3.53	3.98	3.90	2.78	2.45
1948	2.34	1.71	1.57	1.82	1.66	2.17	2.70	3.34	3.91	4.43	4.58	4.57	2.90
1949	3.60	2.69	2.08	1.77	2.12	2.51	3.06	3.55	4.01	3.36	3.03	3.02	2.90
1950	2.05	1.46	1.72	1.79	1.61	1.71	2.25	2.83	3.25	3.71	3.92	4.06	2.53
1951	3.93	3.21	2.72	2.62	2.70	2.85	3.36	3.97	4.44	4.92	5.07	4.81	3.72
1952	4.41	3.35	2.68	1.97	1.97	2.23	2.87	3.53	4.13	4.72	4.94	4.15	3.41
1953	3.31	3.16	2.15	2.31	1.52	2.11	2.65	3.25	3.78	4.33	4.51	3.68	3.06
1954	3.31	3.16	3.11	3.00	2.12	2.67	3.34	3.97	4.55	4.60	3.17	2.83	3.32
1955	2.58	2.12	1.82	1.70	1.94	2.35	2.89	3.48	3.86	4.28	4.73	4.88	3.05
1956	4.71	3.74	3.81	4.05	2.64	3.24	3.88	4.48	5.03	5.57	5.96	6.26	4.45
1957	6.30	5.45	4.58	1.96	1.44	1.40	2.08	2.71	3.26	2.72	1.85	1.85	2.97
1958	1.74	1.77	1.88	1.88	1.39	1.89	2.01	2.64	2.85	3.08	3.19	3.14	2.29
1959	3.11	2.47	2.20	1.79	1.42	1.67	2.04	2.50	3.01	3.22	3.26	2.47	2.43
1960	1.74	1.68	1.59	1.90	2.27	2.64	2.77	3.28	3.71	3.63	3.21	1.69	2.51
1961	1.41	1.39	1.41	1.60	2.01	2.16	2.44	2.97	3.35	3.72	3.62	2.40	2.37
1962	1.98	1.87	1.78	1.88	2.18	2.74	3.22	3.56	4.12	4.55	4.72	4.68	3.11
1963	4.52	4.49	4.23	2.99	2.50	3.10	3.75	4.36	4.91	5.46	5.93	6.30	4.38
1964	6.47	6.17	5.18	5.21	5.12	5.34	5.86	6.34	6.79	7.23	7.51	7.84	6.25
1965	7.31	4.52	4.16	3.95	2.36	2.88	3.53	4.15	4.69	5.25	5.76	6.04	4.55
1966	6.18	5.38	5.20	1.77	1.51	2.16	2.82	3.23	3.13	3.60	3.88	3.96	3.57
1967	3.83	3.89	3.86	2.99	2.81	2.22	2.89	3.55	4.07	4.27	3.43	2.46	3.36
1968	1.88	1.76	1.59	1.43	1.24	1.58	1.95	2.62	3.10	3.61	3.59	2.79	2.26
1969	2.75	1.99	1.51	1.51	1.39	1.94	2.65	3.32	3.93	4.52	4.42	3.31	2.77
1970	2.63	1.99	1.60	1.79	2.23	2.61	3.28	3.91	4.34	2.40	2.31	2.60	2.64
1971	2.84	2.80	2.86	3.18	3.60	4.17	4.75	4.96	5.40	5.28	4.21	1.97	3.84
1972	1.62	1.82	2.23	2.69	3.20	3.60	4.18	4.64	5.18	5.13	3.66	2.89	3.40
1973	2.35	2.04	1.54	1.37	1.74	1.32	1.98	2.59	2.77	2.41	2.17	1.85	2.01
1974	1.69	1.77	1.83	1.96	1.86	2.34	3.02	3.65	3.40	3.58	1.93	1.72	2.40
1975	1.73	1.57	1.65	1.63	1.50	1.79	2.44	3.11	3.71	4.29	4.69	4.85	2.75
1976	4.59	4.19	3.22	2.51	2.03	1.64	1.79	2.48	1.95	2.00	2.16	1.75	2.53
1977	1.86	1.46	1.44	1.39	1.96	1.96	2.65	3.32	3.86	4.46	4.81	4.89	2.84
1978	4.52	3.51	2.32	2.62	2.69	3.21	3.85	4.45	5.01	5.55	5.83	6.07	4.14
1979	5.16	4.42	3.38	2.09	1.73	2.08	2.74	3.02	3.35	3.95	4.34	3.63	3.32
1980	2.44	2.13	2.29	2.01	2.09	2.74	3.41	4.04	4.61	5.18	5.67	6.16	3.56
1981	6.50	6.53	6.14	6.16	3.59	1.87	2.54	3.21	3.83	3.76	3.80	3.75	4.31
1982	3.75	3.63	3.34	3.48	3.36	3.48	3.68	4.30	4.86	5.37	5.08	2.55	3.91
1983	2.51	1.79	1.76	2.06	2.00	2.04	2.27	2.92	3.54	4.17	4.49	4.38	2.83
1984	4.28	2.78	1.83	2.18	2.78	3.39	4.02	4.62	5.16	5.43	5.30	4.26	3.84
1985	3.90	2.31	1.98	2.04	2.09	2.74	3.39	4.03	4.60	4.74	3.48	2.03	3.11
1986	2.38	1.82	2.29	1.51	1.35	1.51	2.15	2.85	3.49	3.90	3.16	2.05	2.37
1987	2.01	1.77	1.48	1.98	2.44	2.09	2.71	3.38	3.98	4.49	3.87	1.90	2.68
1988	1.74	1.68	1.56	1.74	2.32	2.83	3.48	4.11	4.68	5.23	5.00	4.65	3.25
1989	4.29	3.08	2.67	2.47	1.43	1.72	2.40	2.98	3.60	4.22	4.79	5.04	3.22
1990	3.74	2.98	1.79	1.57	1.45	1.67	2.29	2.81	3.33	3.26	2.72	2.27	2.49
1991	1.68	1.53	1.67	1.57	1.73	2.10	2.59	2.77	3.12	3.46	2.89	1.77	2.24
1992	1.57	1.41	1.46	1.89	2.32	2.71	3.18	3.83	4.41	4.60	3.75	2.32	2.79
1993	1.61	1.61	1.62	1.81	2.15	2.52	3.14	3.72	4.10	2.91	3.03	3.09	2.61
1994	3.08	1.93	1.90	2.32	1.90	2.53	3.06	3.71	4.31	2.87	2.37	1.63	2.63
1995	1.59	1.80	1.87	1.71	1.56	2.27	2.97	3.62	4.22	4.81	5.34	5.74	3.12
1996	5.46	5.27	5.27	4.37	4.23	4.73	5.29	5.38	5.30	5.22	4.89	4.00	4.95
AVG	3.11	2.68	2.44	2.26	2.14	2.39	2.92	3.48	3.92	4.10	3.92	3.45	3.07
MAX	7.31	6.53	6.14	6.16	5.12	5.34	5.86	6.34	6.79	7.23	7.51	7.84	7.84
MIN	1.41	1.39	1.35	1.22	1.24	1.32	1.78	2.13	1.95	2.00	1.48	1.51	1.22

Days/mo	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25

[1] Typical domestic wastewater contains 20 to 85 mg/L total nitrogen (Wastewater treatment and use in agriculture - FAO Irrigation and Drainage Paper 47 (1992)).

Typical non-denitrified municipal wastewaters will have between 20 and 30 mg/L of total nitrogen.

[2] TKN + NO3-N, average of all historical data in TCEQ segment 0604 data base

[3] End of month concentration = (inflows * background conc + effluent * effluent conc + lake volume * previous month lake conc)/(inflows + effluent flow + lake volume)

Flat Creek instream impacts

438000 Bullard flow, gpd	5 Bullard P, mg/L[1]	0.12 Background P, mg/L[2]

Bullard, af/mc	41.7	38.0	41.7	40.3	41.7	40.3	41.7	41.7	40.3	41.7	40.3	41.7

P Values in Flat Creek, mg/L, monthly average [3]

TRC/04-15-10

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1940	1.32	0.72	1.16	0.56	0.74	0.92	0.69	2.03	1.78	2.49	0.23	0.21	1.07
1941	0.23	0.30	0.24	0.30	0.39	0.20	0.41	1.66	1.57	0.59	0.52	0.32	0.56
1942	0.39	0.33	0.38	0.18	0.24	0.26	1.13	1.17	0.54	1.20	0.75	0.56	0.59
1943	0.28	0.54	0.46	0.37	0.28	0.23	1.17	2.96	2.66	0.41	1.02	0.54	0.91
1944	0.23	0.20	0.19	0.33	0.16	0.34	1.62	2.34	1.67	2.22	0.80	0.29	0.87
1945	0.20	0.25	0.17	0.15	0.44	0.43	0.27	1.23	1.34	0.31	0.47	0.33	0.46
1946	0.19	0.20	0.20	0.26	0.19	0.19	0.64	0.52	0.32	0.52	0.17	0.23	0.30
1947	0.22	0.30	0.21	0.20	0.32	0.47	1.18	2.20	1.55	1.81	0.78	0.30	0.80
1948	0.33	0.21	0.22	0.40	0.24	0.94	1.33	2.88	2.88	2.61	1.22	1.01	1.19
1949	0.41	0.30	0.26	0.24	0.59	0.86	1.66	1.79	1.92	0.44	0.47	0.61	0.80
1950	0.23	0.17	0.36	0.32	0.23	0.30	1.04	1.68	1.33	1.71	1.11	1.05	0.79
1951	0.75	0.39	0.38	0.47	0.58	0.68	1.71	3.22	2.27	2.55	1.41	0.84	1.27
1952	0.69	0.36	0.34	0.24	0.35	0.55	2.41	3.65	3.61	3.65	1.48	0.52	1.49
1953	0.40	0.56	0.24	0.51	0.17	1.22	1.33	2.31	2.27	2.77	1.28	0.45	1.13
1954	0.51	0.57	0.61	0.55	0.25	1.53	3.47	3.65	3.61	1.08	0.31	0.43	1.38
1955	0.41	0.28	0.26	0.26	0.43	0.80	1.56	2.44	1.50	1.86	2.32	1.33	1.12
1956	0.88	0.41	0.89	1.24	0.26	2.54	3.59	3.65	3.61	3.65	2.60	2.27	2.13
1957	1.54	0.64	0.55	0.17	0.17	0.20	1.66	2.06	2.06	0.37	0.21	0.32	0.83
1958	0.26	0.30	0.35	0.32	0.17	0.71	0.40	1.97	0.73	0.84	0.75	0.62	0.62
1959	0.62	0.31	0.33	0.24	0.18	0.34	0.57	0.96	1.59	0.85	0.71	0.30	0.58
1960	0.21	0.26	0.23	0.46	0.68	0.88	0.63	1.68	1.63	0.72	0.47	0.17	0.67
1961	0.18	0.19	0.20	0.29	0.60	0.46	0.66	1.52	1.27	1.35	0.70	0.25	0.64
1962	0.27	0.29	0.28	0.35	0.57	1.61	1.49	1.22	2.88	2.08	1.30	1.00	1.11
1963	0.86	0.96	0.73	0.31	0.34	2.48	3.53	3.59	3.61	3.59	3.28	2.64	2.16
1964	1.88	1.05	0.59	1.24	1.05	1.64	3.59	3.59	3.55	3.59	2.73	3.04	2.29
1965	1.09	0.30	0.66	0.70	0.23	1.52	3.42	3.59	3.18	3.65	3.61	2.08	2.00
1966	1.71	0.65	0.99	0.15	0.20	1.69	2.74	1.25	0.58	1.71	1.23	0.95	1.15
1967	0.73	0.91	0.80	0.35	0.48	0.28	2.92	3.65	2.40	1.22	0.41	0.28	1.20
1968	0.24	0.27	0.22	0.19	0.15	0.34	0.52	2.49	1.48	1.86	0.75	0.34	0.74
1969	0.52	0.23	0.19	0.23	0.18	0.87	3.36	3.59	3.61	3.42	0.88	0.36	1.45
1970	0.33	0.24	0.21	0.35	0.76	0.90	3.36	3.59	1.99	0.22	0.40	0.73	1.09
1971	0.75	0.54	0.61	1.03	1.46	3.09	3.53	1.46	2.73	1.06	0.46	0.18	1.41
1972	0.21	0.37	0.72	1.13	1.59	1.45	3.00	2.29	3.55	1.10	0.35	0.36	1.34
1973	0.31	0.29	0.19	0.18	0.43	0.16	1.38	1.74	0.68	0.35	0.33	0.26	0.52
1974	0.25	0.32	0.32	0.39	0.29	0.95	3.31	3.26	0.57	0.94	0.19	0.25	0.92
1975	0.29	0.22	0.28	0.25	0.21	0.40	2.01	3.26	3.04	3.04	2.06	1.33	1.37
1976	0.80	0.63	0.37	0.31	0.27	0.21	0.34	2.67	0.25	0.37	0.46	0.23	0.58
1977	0.35	0.18	0.21	0.19	0.86	0.34	3.12	3.65	2.37	3.59	1.87	1.21	1.49
1978	0.72	0.38	0.25	0.76	0.57	1.77	3.65	3.59	3.61	3.65	2.06	1.94	1.91
1979	0.61	0.54	0.38	0.22	0.23	0.58	2.39	0.88	1.13	3.12	1.78	0.47	1.03
1980	0.26	0.31	0.51	0.29	0.40	2.77	3.65	3.65	3.61	3.65	3.38	3.42	2.16
1981	2.55	1.58	0.99	1.47	0.27	0.18	2.31	3.59	3.55	0.75	0.85	0.76	1.57
1982	0.81	0.68	0.54	0.87	0.63	0.85	1.00	3.65	3.61	3.17	0.87	0.21	1.41
1983	0.46	0.21	0.28	0.53	0.34	0.38	0.54	2.61	3.33	3.65	1.63	0.86	1.23
1984	0.85	0.26	0.21	0.64	1.79	2.92	3.65	3.65	3.61	1.81	1.04	0.48	1.74
1985	0.62	0.22	0.28	0.38	0.40	2.54	3.42	3.65	3.61	1.26	0.36	0.21	1.41
1986	0.72	0.22	0.86	0.17	0.17	0.25	1.47	3.65	3.61	1.59	0.39	0.22	1.11
1987	0.34	0.25	0.19	0.77	0.92	0.30	1.94	3.65	3.38	2.49	0.52	0.18	1.24
1988	0.26	0.26	0.22	0.34	1.26	1.42	3.31	3.65	3.61	3.59	0.89	0.76	1.63
1989	0.69	0.31	0.39	0.40	0.16	0.38	2.31	1.81	3.44	3.65	3.61	1.61	1.56
1990	0.38	0.36	0.19	0.21	0.20	0.33	1.44	1.39	1.86	0.64	0.36	0.31	0.64
1991	0.21	0.21	0.30	0.23	0.32	0.61	1.12	0.67	1.09	1.18	0.38	0.19	0.54
1992	0.22	0.18	0.22	0.57	0.79	0.96	1.43	3.65	3.61	1.30	0.45	0.23	1.14
1993	0.19	0.25	0.26	0.36	0.59	0.81	2.44	2.55	1.65	0.31	0.71	0.68	0.90
1994	0.63	0.20	0.32	0.81	0.25	2.12	1.63	3.65	3.61	0.28	0.32	0.19	1.17
1995	0.24	0.38	0.34	0.25	0.22	3.61	3.65	3.65	3.61	3.65	3.61	2.49	2.14
1996	0.96	0.97	1.19	0.51	0.81	2.70	3.65	1.38	1.10	1.09	0.80	0.48	1.30
AVG	0.57	0.40	0.41	0.44	0.47	1.03	2.03	2.58	2.37	1.87	1.13	0.77	1.17
MAX	2.55	1.58	1.19	1.47	1.79	3.61	3.65	3.65	3.61	3.65	3.61	3.42	3.65
MIN	0.18	0.17	0.17	0.15	0.15	0.16	0.27	0.52	0.25	0.22	0.17	0.17	0.15

Days/mo	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25

[1] Typical municipal wastewaters will have between 5 and 20 mg/L of total phosphorus. (EPA, 2006)

EPA/625/R-06/016, September 2006, Process Design Manual, Land Treatment of Municipal Wastewater Effluents

[2] Average of all historical data in TCEQ segment 0604 data base

[3] Average month concentration = (inflows * background conc + effluent * effluent conc)/(inflows + effluent flow)

Flat Creek instream impacts

438000 Bullard flow, gpd 20 Bullard Tot-N, mg/L[1] 1.10 Background Tot-N, mg/L[2]

Bullard, af/mc	41.7	38.0	41.7	40.3	41.7	40.3	41.7	41.7	40.3	41.7	40.3	41.7

Tot-N Values in Flat Creek, mg/L, monthly average[3] TRC/04-15-10

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVERAGE
1940	5.74	3.41	5.12	2.82	3.50	4.18	3.31	8.48	7.54	10.29	1.53	1.44	4.78
1941	1.51	1.80	1.56	1.78	2.14	1.42	2.24	7.08	6.73	2.90	2.64	1.87	2.81
1942	2.16	1.92	2.09	1.32	1.56	1.64	5.01	5.17	2.73	5.30	3.56	2.80	2.94
1943	1.71	2.74	2.44	2.08	1.71	1.54	5.17	12.09	10.96	2.21	4.57	2.73	4.16
1944	1.51	1.40	1.38	1.90	1.25	1.97	6.90	9.69	7.09	9.25	3.75	1.77	3.99
1945	1.40	1.59	1.28	1.20	2.36	2.29	1.69	5.41	5.82	1.82	2.46	1.90	2.43
1946	1.37	1.40	1.40	1.63	1.36	1.36	3.12	2.64	1.88	2.66	1.29	1.52	1.80
1947	1.48	1.78	1.46	1.40	1.88	2.47	5.21	9.16	6.65	7.63	3.65	1.80	3.71
1948	1.90	1.43	1.50	2.17	1.57	4.26	5.77	11.79	11.79	10.74	5.35	4.53	5.23
1949	2.23	1.81	1.66	1.58	2.93	3.96	7.08	7.57	8.07	2.34	2.47	2.99	3.72
1950	1.53	1.30	2.02	1.86	1.51	1.80	4.65	7.13	5.80	7.27	4.94	4.72	3.71
1951	3.53	2.16	2.11	2.45	2.88	3.28	7.27	13.09	9.45	10.51	6.10	3.91	5.56
1952	3.29	2.02	1.96	1.56	1.97	2.77	9.98	14.76	14.63	14.76	6.38	2.64	6.39
1953	2.19	2.79	1.57	2.61	1.31	5.35	5.77	9.60	9.45	11.37	5.60	2.37	5.00
1954	2.60	2.83	2.99	2.76	1.59	6.57	14.08	14.76	14.63	4.82	1.83	2.31	5.98
1955	2.23	1.73	1.62	1.62	2.30	3.72	6.66	10.08	6.45	7.85	9.63	5.77	4.97
1956	4.05	2.24	4.06	5.42	1.66	10.47	14.52	14.76	14.63	14.76	10.71	9.42	8.89
1957	6.58	3.12	2.76	1.30	1.31	1.39	7.08	8.62	8.62	2.06	1.45	1.86	3.85
1958	1.66	1.81	2.01	1.88	1.28	3.38	2.17	8.28	3.46	3.90	3.52	3.04	3.03
1959	3.04	1.83	1.92	1.55	1.32	1.95	2.83	4.36	6.77	3.95	3.39	1.79	2.89
1960	1.44	1.64	1.54	2.41	3.27	4.03	3.09	7.13	6.95	3.41	2.46	1.30	3.22
1961	1.33	1.38	1.42	1.77	2.97	2.40	3.18	6.51	5.55	5.88	3.34	1.62	3.11
1962	1.67	1.78	1.72	1.99	2.84	6.86	6.40	5.34	11.79	8.70	5.68	4.50	4.94
1963	3.97	4.36	3.45	1.83	1.97	10.25	14.30	14.52	14.63	14.52	13.33	10.86	9.00
1964	7.91	4.69	2.92	5.42	4.69	6.99	14.52	14.52	14.40	14.52	11.22	12.40	9.52
1965	4.86	1.81	3.21	3.33	1.52	6.53	13.87	14.52	12.95	14.76	14.63	8.70	8.39
1966	7.27	3.14	4.47	1.22	1.41	7.18	11.24	5.46	2.88	7.27	5.40	4.31	5.10
1967	3.45	4.15	3.75	2.00	2.49	1.74	11.94	14.76	9.93	5.34	2.22	1.72	5.29
1968	1.56	1.66	1.51	1.37	1.22	1.95	2.66	10.29	6.38	7.85	3.52	1.95	3.49
1969	2.67	1.54	1.36	1.51	1.35	3.99	13.67	14.52	14.63	13.87	4.05	2.03	6.27
1970	1.93	1.58	1.44	2.01	3.56	4.13	13.67	14.52	8.34	1.48	2.19	3.45	4.86
1971	3.56	2.73	3.00	4.62	6.29	12.59	14.30	6.29	11.22	4.73	2.41	1.33	6.09
1972	1.46	2.08	3.41	5.00	6.78	6.24	12.24	9.51	14.40	4.89	1.98	2.02	5.83
1973	1.84	1.76	1.37	1.32	2.28	1.25	5.97	7.37	3.26	2.00	1.92	1.64	2.66
1974	1.59	1.87	1.88	2.13	1.78	4.30	13.47	13.28	2.85	4.29	1.36	1.60	4.20
1975	1.74	1.48	1.72	1.61	1.45	2.19	8.41	13.28	12.42	12.40	8.62	5.77	5.93
1976	3.75	3.08	2.06	1.84	1.68	1.45	1.95	10.99	1.60	2.07	2.43	1.53	2.87
1977	1.97	1.34	1.43	1.38	3.97	1.95	12.74	14.76	9.83	14.52	7.89	5.32	6.42
1978	3.43	2.12	1.59	3.58	2.82	7.49	14.76	14.52	14.63	14.76	8.62	8.15	8.04
1979	3.00	2.74	2.09	1.47	1.54	2.90	9.88	4.05	5.00	12.74	7.54	2.44	4.62
1980	1.64	1.83	2.59	1.76	2.20	11.35	14.76	14.76	14.63	14.76	13.73	13.87	8.99
1981	10.51	6.75	4.48	6.34	1.69	1.34	9.60	14.52	14.40	3.55	3.92	3.59	6.73
1982	3.75	3.28	2.74	4.01	3.07	3.94	4.51	14.76	14.63	12.91	4.01	1.45	6.09
1983	2.44	1.45	1.73	2.69	1.94	2.10	2.72	10.74	13.53	14.76	6.95	3.97	5.42
1984	3.95	1.65	1.43	3.10	7.57	11.94	14.76	14.76	14.63	7.63	4.67	2.48	7.38
1985	3.03	1.48	1.72	2.12	2.17	10.47	13.87	14.76	14.63	5.51	2.01	1.43	6.10
1986	3.41	1.50	3.97	1.30	1.31	1.61	6.33	14.76	14.63	6.78	2.16	1.50	4.94
1987	1.97	1.61	1.38	3.60	4.22	1.79	8.15	14.76	13.73	10.29	2.64	1.33	5.46
1988	1.63	1.63	1.50	1.94	5.51	6.14	13.47	14.76	14.63	14.52	4.10	3.57	6.95
1989	3.31	1.85	2.14	2.19	1.24	2.10	9.60	7.63	13.95	14.76	14.63	6.86	6.69
1990	2.10	2.02	1.38	1.46	1.41	1.90	6.22	6.00	7.83	3.10	2.05	1.85	3.11
1991	1.43	1.45	1.79	1.52	1.88	3.01	4.97	3.23	4.85	5.19	2.13	1.38	2.73
1992	1.48	1.35	1.49	2.85	3.70	4.35	6.19	14.76	14.63	5.69	2.36	1.54	5.03
1993	1.37	1.61	1.63	2.04	2.91	3.79	10.08	10.51	7.04	1.83	3.37	3.27	4.12
1994	3.06	1.42	1.87	3.77	1.62	8.85	6.95	14.76	14.63	1.73	1.88	1.38	5.16
1995	1.56	2.10	1.94	1.61	1.49	14.63	14.76	14.76	14.63	14.76	14.63	10.29	8.93
1996	4.35	4.41	5.25	2.61	3.79	11.09	14.76	5.97	4.89	4.86	3.75	2.48	5.68
AVG	2.86	2.20	2.23	2.34	2.47	4.61	8.50	10.65	9.80	7.88	4.99	3.61	5.18
MAX	10.51	6.75	5.25	6.34	7.57	14.63	14.76	14.76	14.63	14.76	14.63	13.87	14.76
MIN	1.33	1.30	1.28	1.20	1.22	1.25	1.69	2.64	1.60	1.48	1.29	1.30	1.20

Days/mo	31	28.25	31	30	31	30	31	31	30	31	30	31	365.25

[1] Typical domestic wastewater contains 20 to 85 mg/L total nitrogen (Wastewater treatment and use in agriculture - FAO Irrigation and Drainage Paper 47 (1992)).

Typical non-denitrified municipal wastewaters will have between 20 and 30 mg/L of total nitrogen.

[2] Average of all historical data in TCEQ segment 0604 data base

[3] Average month concentration = (inflows * background conc + effluent * effluent conc)/(inflows + effluent flow)

	TCEQ DATA BASE, 1972-2008			
	Average Surface Water Values	Median Surface Water Values		Surface WQ Stds
Parameter	Neches Seg 0604	Neches Seg 0604	No. Samples	Segment 0604
TDS, mg/L	115.5		487	200
Chloride, mg/L	26.3		3808	50
Sulfate, mg/L	21.7		1023	50
Iron, mg/L	0.085		464	
pH, units				6.0-8.5
Tot-Phosphorus, mg/L	**0.12**	0.07	578	
Tot-NO3-N, mg/L	0.29	0.20	433	
TKN, mg/L	0.81	0.68	352	
Tot-N, mg/L (TKN+NO3)	**1.10**	0.88	(calc.)	

TRC

JAMES L. MACHIN, P.E.

EDUCATION

M.S., Environmental and Water Resources Engineering, University of Texas at Austin, 1980
M.B.A., University of Michigan, Ann Arbor, MI, 1974
B.S.E., Engineering, Princeton University, Princeton, NJ, 1971

PROFESSIONAL REGISTRATIONS/CERTIFICATIONS

Professional Engineer, Texas, No. 53349
Professional Engineer, Arizona, No. 29159
OSHA 40-hr HAZWOPER training, including Supervisor Certification

AREAS OF EXPERTISE

Mr. Machin has been in environmental and water resources consulting for over 30 years. His work has been in the fields of water resources engineering, hydrology, and water quality; design and construction; permitting and compliance; environmental engineering and water/waste treatment; environmental remediation and investigations; and environmental impact assessments. He is very knowledgeable in environmental regulations. His experience has included surface-water availability studies, storm water management and design studies, intensive surface-water quantity and quality investigations, environmental impact assessments related to both water projects and multi-disciplinary projects, flood hydrograph and flood plain modeling, water/waste treatment studies, instream water quality impacts and modeling, storm water and wastewater permitting, and development of comprehensive planning documents for various governmental clients.

EXPERIENCE

Water Team Leader, TRC, Austin, TX, 2004-present.
Senior Engineer, R. J. Brandes Company, Austin, TX, 1997-2004.
Senior Engineer/Project Manager, Radian International LLC, Austin, TX, 1977-1997.
Hydrologist, Texas Water Quality Board, Austin, TX, 1975-1977.
Manufacturing Engineer, Texas Instruments, Inc., Austin, TX, 1974.
Pipestress Engineer, C-E Lummus, G.m.b.H., Wiesbaden, Germany, 1971-1972.

Water Quality and Water Resources

- Directed water quality modeling and nutrient impact evaluation of proposed controversial WWTP discharge to a stream in the Edwards Aquifer Contributing Zone near Austin, Texas. Conducted instream dye study.

Designed and implemented long-term monitoring plan to determine impacts on algal growth in the stream and an impoundment.

- Designed and implemented long-term storm water and base flow water quality monitoring program for a subdivision and with a wastewater treatment facility to determine nutrient impacts on sensitive spring-fed stream in the Lake Travis watershed near Austin, Texas.

- Directed obtaining permits for proposed major seawater desalination plant in Texas. Performed outfall diffusion modeling for brine discharge into the Gulf of Mexico, including extensive field data collection. Worked closely with water quality team from TCEQ and TWDB for this important project.

- Performed instream studies and modeling to support permit renewals for both of Brownsville, Texas' WWTPs. Work was accepted by the State and saved the client millions of dollars in upgrades.

- Prepared technical reports for three WWTP permit renewals for Laredo, Texas, and also several smaller facilities in the Lower Rio Grande Valley.

- Prepared technical reports and performed instream studies and water quality analysis to support discharges for seven proposed brackish groundwater desalination plants in south Texas. Established recording instream monitoring stations.

- Management of the development and application of water availability model for the Rio Grande Basin in Texas and Mexico for the Texas Commission on Environmental Quality (TCEQ). This complex project involved both prior appropriation and type of use priority water rights, evaluation of interstate compacts and international treaties, development of naturalized flows in both Texas and Mexico, and determination of the share of water owned by both countries. Also directed the development and application of water availability models for the Sulphur and Colorado River Basins. For the Colorado, performed special study to quantify channel losses.

- Support for development of dam and reservoir on the Rio Grande for water supply development for the Lower Rio Grande Valley. Included preparation of comprehensive Environmental Assessment. Significant coordination with TCEQ for water rights permit and Section 401 water quality certification, U.S. Army Corps of Engineers (USACE) to obtain Sections 404/10 permit, U.S. International Boundary and Water Commission, and U.S. Fish and Wildlife Service Section 7 endangered species consultation. Established recording, long-term water quality monitoring stations on the Rio Grande.

- Participated in eutrophication studies of lakes in Texas and North Carolina which included modeling of the impacts of proposed wastewater discharges.

- Performed water quality modeling for a proposed discharge from a liquefied natural gas facility in Louisiana. Analyzed water quality data, calibrated the model to the existing data, and performed modeling to predict the effects of the proposed discharge.

- Directed a water quality investigation and modeling study of a bayou near Houston, Texas for a petroleum refinery. Data were collected over a one-year period at several locations. A water quality model was developed to support an increase in wastewater discharge anticipated from the addition of a new petrochemical facility. Also performed flood plain modeling on the same bayou and obtained state permit for development of the proposed facility.

- Directed an intensive water quality study of a creek receiving wastewater discharge to evaluate the potential for a site-specific water quality standards change. Included water quality and biological data collection, modeling, and aquatic organism bioassay testing.

- Obtained permanent and temporary water rights, USACE 404/10 permits, TPDES storm water and wastewater permits, and Texas Parks & Wildlife Sand & Gravel permits for several sand and gravel mining operations. Provided technical support and expert testimony for two contested case hearings involving geomorphological changes to a river where instream dredging was being conducted.

- Performed intensive surface-water investigation over a one-year period for proposed mine in Wood, Rains, and Hopkins Counties, Texas. Evaluated water quality and quantity and bottom sediments at numerous stream and impoundment sites, assessed impacts on water quality and water rights, and identified potential issues affecting the project.

- Designed, constructed, and performed surface-water data collection system/program for lignite mine in Zavala County, Texas. Data were collected over one year. Mr. Machin also trained local personnel to collect water quality samples, service gages, and perform measurements.

- Conducted an assessment of hydrology-related regulatory risks for a lignite mining prospect in Panola County, Texas.

- Surface-water modeling and groundwater evaluation of water quality impacts of potential spills from controversial gasoline pipeline in environmentally sensitive area. Impacts to both rivers and reservoirs were evaluated. Contributed to preparation of comprehensive Environmental Assessment.

- Performed analysis of water rights and availability of water in the Trinity River Basin, Texas. Analysis was used to support major water right application involving reuse of return flows through diversions from the Trinity River, treatment in constructed wetlands, and discharge to a water supply reservoir.

- Directed several studies to conduct detailed surface-water field data collection programs including the design and construction of stream gaging stations and automated sampling stations. Also directed and participated in several comprehensive environmental assessments of proposed industrial, mining, and power generation sites in various regions of the country. These studies involved extensive field work and analyses in the areas of water quality, flood plain, and sediment mathematical modeling; design and implementation of water and sediment sampling programs; statistical data analysis; impact analysis; and surface-water supply availability.

- Participated in evaluation of water rights under low-flow conditions in several states including water quality, aquatic biota, and water usage issues.

- Preparation of Storm Water Pollution Prevention Plans and Water Pollution Abatement Plans for multiple industrial and municipal clients, and pipeline and highway construction projects.

- Prepared NPDES stormwater permit applications for several furniture manufacturing facilities. Included training of plant personnel in stormwater flow measurement and flow-weighted sampling techniques.

- Prepared Stormwater Pollution Prevention Plans at Air Force bases in Texas, Nevada, South Dakota, and Delaware. Plans involved evaluation of complex facilities with many activities containing significant stormwater exposure. Evaluated cross-connections. Developed Best Management Practices for control of stormwater pollution from numerous sources. Participated in design of stormwater detention impoundments.

- Directed a comprehensive stormwater management study at a petroleum refinery in Indiana. Designed and evaluated four alternative systems. Project involved preparation of detailed topographic maps, modeling of runoff rates and quantities, design of conveyance systems, design of storage devices for surge capacity, evaluation of treatment needs, and recommendations for reducing potentially explosive vapor levels in sewers.

- Performed a stormwater management study at a petroleum refinery in Illinois. Included evaluation of modifications to and construction of surface impoundments. Directed a water quality study of a creek receiving wastewater discharge to evaluate the potential for a site-specific effluent limitations variance. Included water quality and biological data collection, and fish bioassay testing.

- Performed a special study on a 5-mile reach of the Yampa River in Colorado. Involved numerous hydrologic measurements over a period of time to quantify exchanges between the surface-water and ground-water systems. The study was used to support permitting activities at a mine and mine-mouth power plant.

- Conducted a nine-month analysis of streamflow in Ship Creek, an important water supply and recreational stream in Anchorage, Alaska. Measurements were performed at various locations in the creek to determine the degree of groundwater recharge and discharge over time. The study was used to support feasibility studies for contaminated groundwater control in reaches of the stream where groundwater discharge was occurring.

- Designed contaminated runoff diversion, control, and collection system for railroad yard in Oklahoma.

- For EPA, participated in major study of the impacts of using large quantities of water for energy development in eight western states.

- Designed and executed stormwater sampling program at manufacturing facility in Austin, Texas.

- Mr. Machin's work at the Texas Water Quality Board was primarily within the areas of engineering and water quality analysis, waste treatment, and economic evaluations. He helped design and manage a water quality investigation and modeling study for Lake Livingston, a major water supply reservoir for the City of Houston. He also managed a study of impacts of different types of non-point sources throughout Texas. He managed a study of proposed changes in water quality standards for low-gradient streams in east Texas.

PROFESSIONAL AFFILIATIONS

Water Environment Association of Texas
American Society of Civil Engineers
Texas Water Conservation Association

PUBLICATIONS AND PRESENTATIONS

Mr. Machin has extensive technical writing experience and has authored or co-authored a number of published technical papers and presentations at national symposia.

EXPERT TESTIMONY

Mr. Machin has provided deposition and expert testimony on behalf of several clients in cases involving water quality, water quantity, and hazardous waste.